Better Cold-Weather Starts for Biodiesel Fuel

Anyone who has tried starting a car on a frigid January morning will appreciate the efforts of Agricultural Research Service (ARS) scientists at the National Center for Agricultural Utilization Research in Peoria, Illinois. They have improved biodiesel's ability to start up engines in cold weather.

The research is good news for soybean farmers because it will speed the commercial use of biodiesel fuels made from soybean oil.

When overnight temperatures fall near or below freezing, biodiesel fuels form small, solid, waxy crystals that stick together to form bigger ones. These larger crystals block fuel filters and plug fuel lines.

To solve this problem, ARS chemical engineer Robert O. Dunn has developed a three-step winterization process that involves mixing in additives, chilling the fuel, and filtering out solids. In laboratory tests, researchers have produced biodiesel fuels capable of starting engines at temperatures as low as 5°F, making them comparable to petroleum-based diesel fuels.

"Using additives makes the fuel easier to pour," says Dunn. Other researchers have tried to winterize biodiesel fuels without additives, but they found that to significantly improve the cold flow properties, they had to remove 70 percent of the starting material.

"That was like throwing out the baby with the bath water," says Dunn. "Our technique produces 80 percent liquid fuel. The remaining 20 percent solids can be stored and used as fuel in warmer weather."

There is still one problem the researchers are trying to resolve: Winterizing causes changes in the makeup of biodiesel fuels that lead to a lower cetane number—as well as a decreased stability during long-term storage that the scientists are also trying to improve.

The cetane number, which is similar to the octane number of gasoline, is one important way to measure biodiesel fuel quality.

"Unfortunately, harmful exhaust emissions, especially nitrogen oxides, may be expected with a lower cetane number," says chemist ARS Gerhard H. Knothe, who is also trying to enhance the quality of biodiesel fuels. He's developing new cetane improvers that will help the biodiesel fuels burn faster. With faster burning fuels and lower nitrogen oxide emissions, less pollution by ozone may be possible.

Research efforts like these can help put biodiesel fuels in city buses, in government and industry fleet cars, and in heavy equipment used in underground mining operations. These vehicles are among the first in the nation to test and pave the way for continued acceptance of biodiesel as an alternative fuel or as a fuel extender for mixing with standard petroleum diesel fuels. The federal Energy Policy Act requires 75 percent of all new state and federal vehicles to be fitted for alternative fuels by the year 2001.

According to a Department of Energy publication, the United States spends about $60 billion a year to import 50 percent of its oil. Since the early 1980s, domestic oil production has declined, reducing U.S. employment in this industry.

The ARS research can help jumpstart the adoption of biodiesel in snow-removal trucks and in city buses. The use of biodiesel fuels in all U.S. city buses would require oil from 43 million bushels of soybeans annually. There are enough niche markets for biodiesel to make plenty of profits for the nation's 400,000 soybean growers.—By **Linda Cooke McGraw,** ARS.

KEITH WELLER (K8024-1)

Chemical engineer Robert Dunn inspects chilled fuels that have been winterized for better engine start-ups in cold weather. The clear fuel on the right will ignite more effectively than the cloudy one.

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